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## GEOMETRY.

**426. Proposed by R. D. CARMICHAEL, Indiana University.**

On a given chord of a circle as a base construct an isosceles triangle, with vertex outside of the circle, such that its sides shall be divided in a given ratio by their points of intersection with the circle.

## CALCULUS.

**347. Proposed by R. D. CARMICHAEL, Indiana University.**

Show that the differential equation

$$9 \left( \frac{d^2 y}{dx^2} \right)^2 \frac{d^5 y}{dx^5} - 45 \frac{d^2 y}{dx^2} \frac{d^3 y}{dx^3} \frac{d^4 y}{dx^4} + 40 \left( \frac{d^3 y}{dx^3} \right)^3 = 0$$

remains unchanged when the variables  $x$  and  $y$  undergo any projective transformation (Goursat-Hedrick, *Mathematical Analysis*, p. 86, ex. 18).

**348. Proposed by E. L. DODD, University of Texas.**

Let  $(x_1, x_2, \dots, x_n)$  be a point in  $n$  dimensions lying in the "sphere"  $S$  defined by

$$x_1^2 + x_2^2 + \dots + x_n^2 \leq 1.$$

Let  $T$  be that part of  $S$  defined by a set of  $n$  linear homogeneous inequalities with non-vanishing determinant; thus:

$$a_i x_1 + b_i x_2 + \dots + k_i x_n \geq 0, \quad i = 1, 2, \dots, n.$$

Find the value of

$$\frac{\int \dots \int_T dx_1 \dots dx_n}{\int \dots \int_S dx_1 \dots dx_n};$$

in other words, find the magnitude of a "solid angle" in  $n$  dimensions, with the "sphere" as unit solid angle.

*Note.*—This problem was discussed and left unsolved by Schläfli in the Quarterly Journal of Mathematics for 1858, 1860, 1867. EDITOR.

**349. Proposed by C. N. SCHMALL, New York City.**

If  $y = a \cos (\log x) + b \sin (\log x)$ , eliminate the constants  $a$  and  $b$  and obtain the equation

$$x^2 \frac{d^2 y}{dx^2} + x \frac{dy}{dx} + y = 0.$$

## MECHANICS.

**282. Proposed by R. P. LOCHNER, Philadelphia, Pa.**

A car weighing 10 tons (2,240 lb. each) attains a speed of 15 miles per hour from rest in 24 seconds, during which it covers 100 yards. If the space-average of the resistances is 30 lb. per ton, find the average horse-power used to drive the car. (Morley's "*Mechanics for Engineers*," p. 66).

**283. Proposed by C. N. SCHMALL, New York, N. Y.**

The maximum length of a certain chain which can be suspended from one end without breaking is  $l$ . It is desired to form a catenary with a length  $2l/k$  of the chain, the points of support being a distance  $d$  apart, in the same horizontal line.

Show that the maximum value of  $d$  is  $\frac{2l}{k} (k^2 - 1)^{\frac{1}{2}} \log \left( \frac{k+1}{k-1} \right)^{\frac{1}{2}}$ .

## NUMBER THEORY AND DIOPHANTINE ANALYSIS.

**199. Proposed by R. P. LOCHNER, Philadelphia, Pa.**

Find three integral squares such that the sum of every two of them shall be a square.—Also p's "Algebra."